

DENTAL CARIES AND GINGIVITIS AMONG 12-  
YEAR-OLD CHILDREN IN PERI-URBAN KITALE,  
TRANS-NZOIA DISTRICT, KENYA.

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DR. RICHARD OKOMBO OWINO, BDS (Nrb)

THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF MASTER OF DENTAL SURGERY (MDS) DEGREE IN  
PAEDIATRIC DENTISTRY

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## DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

Dr. Richard Okombo Owino

Signed  Date 26<sup>th</sup> November 2007.



## APPROVAL

This thesis has been submitted with our approval as University supervisors.

Dr Mary Masiga BDS, MSc

Senior Lecturer

Department of Paediatric Dentistry & Orthodontics,

School of Dental Sciences

University of Nairobi

Signed  Date 27/11/07

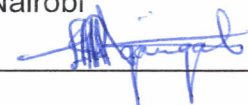
Prof Peter M. Ng'ang'a BDS, MSD, PhD

Associate Professor

Department of Paediatric Dentistry & Orthodontics,

School of Dental Sciences

University of Nairobi

Signed  Date 27/11/07

Dr Francis G. Macigo BDS, MPH, PGD-STI

Senior Lecturer

Department of Periodontology, Community and Preventive Dentistry

School of Dental Sciences

University of Nairobi

Signed  Date 27/11/07

## DEDICATION

This Thesis is dedicated to my wife Caroline W. Owino and my son Richard A.

Owino Jr. for their understanding and support throughout my studies.

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## ACRONYMS

ANOVA - Analysis of Variance

ART - Atraumatic Restorative Technique

COHO - Community oral health officer

CPITN - Community Periodontal Index of Treatment Needs

DEO - District Education Officer

DMFT - Decayed Missing and Filled Teeth

MOH - Medical Officer of Health

SPSS - Statistical Package for Social Sciences

WHO - World Health Organisation

Caries Res - Caries Research

E Afr Med J - East African Medical Journal

Brit Dent J - British Dental Journal

Odontostomatol Trop - Odontostomatologie Tropicale

Int J of Paed Dent - International Journal of Paediatric Dentistry

Acta Odontol Scand - Acta Odontologica Scandinavica

Community Dent Oral Epidemiol - Community Dentistry and Oral Epidemiology

Annals Hum Biol - Annals of Human Biology

Afri J Oral Health Sci – African Journal of Oral Health Sciences

J Nutr – Journal of Nutrition

SADJ – Saudi Arabian Dental Journal

Int Dent J – International Dental Journal

J Indian Soc Pedo Prev Dent – Journal Indian Society of Paediatric and Preventive

Dentistry.

## ABSTRACT

**Background:** One of the WHO global health goals stated that the global average for dental caries should not have been more than 3 DMFT at 12 years of age by the year 2000. However the prevalence of dental caries, gingivitis and dental treatment needs among 12-year-old children in Kitale municipality has never been investigated this study will form a baseline database for this cohort.

**Objective:** To describe the prevalence of dental caries and gingivitis and the dental treatment needs among 12-year-old children in Kitale municipality.

**Study design:** Descriptive cross-sectional study.

**Setting:** Primary schools in Kitale municipality, Trans Nzoia district.

**Materials and methods:** Eight schools were randomly selected from the 4 educational zones. Two schools represented each zone. A total of 292 children aged 12 years were randomly selected from the eight schools. Data was collected using a self administered questionnaire and a data collection form.

**Data analysis:** Data was analysed using SPSS. The mean was computed for DMFT, frequencies for prevalence of caries and gingivitis. Mann Whitney U test and Kruskal Wallis were used to test associations between dental disease and oral health knowledge, practices and oral health seeking behaviour. Data was presented in the form of tables and graphs.

**Results:** The overall prevalence of dental caries was 50.3%. The prevalence of dental caries when only the permanent teeth were considered was 44.5% with a mean DMFT of 0.92 (SD 1.36). Girls had a significantly higher caries experience (DMFT) than boys ( $p < 0.05$ ). The main treatment need indicated for decayed teeth was one surface restoration, with 46.9% of all the children requiring this kind of treatment. Endodontics was indicated in 7.5% of the children while extractions were the least required treatment with 5.1% of the children examined requiring this kind of treatment.

The prevalence of gingivitis was 77.7%. Out of these 38.7% of the children required professional dental care (scaling and oral prophylaxis). Majority (67.5%) of the children brushed their teeth. Out of those who brushed their teeth, 87.8% used toothpaste. 64.5% used a tooth brush, 16.8% used mswaki and 16.2% used mswaki and toothbrush. These oral hygiene practices did not have an influence on caries experience or on the prevalence of gingivitis. The utilization of dental services was low with only 36.3% of the children having visited the dentist.

**Conclusion:** The prevalence of dental caries and gingivitis was high. The mean DMFT was 0.92(SD 1.36). There was a greater need for one surface restoration and mouth scaling for these children. Knowledge and oral hygiene practices did not influence the prevalence of gingivitis.

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# CHAPTER 1

## INTRODUCTION AND LITERATURE REVIEW

Oral diseases qualify as a major public health concern owing to their high prevalence and incidence in all regions of the world (1). Dental caries and gingivitis are the two commonest dental diseases affecting children worldwide. These two diseases are to a large extent the result of the presence of dental plaque. Dental plaque is defined as an adherent structured mass that forms on the tooth surfaces and is composed primarily of micro-organisms (2).

The period of adolescence begins between 10 and 12 years of age and ends at 20 years of age. At this stage there are progressive anatomical, physiological and mental changes in the child that are associated with new freedoms, responsibilities and social demands (3). Adolescents may present with extensive dental caries and periodontal disease produced by poor oral hygiene, lack of parental supervision and hormonal changes. The progression of dental caries and gingivitis are seen to reach a peak during middle adolescence (3). Therefore, the dental practitioners' knowledge of the prevalence of dental caries and gingivitis among 12 yr-old children and their treatment needs will enable the formulation of appropriate oral health management strategy for these children.

One of the WHO global health goals stated that the global average for dental caries would be no more than 3 DMFT at 12 years of age by the year 2000. Therefore this study will give baseline data for the caries experience for this cohort and find out if the WHO goals have been met.



## 1.1 DENTAL CARIES

Although dental caries is not life threatening, it can be painful, disfiguring and expensive to manage. Thousands of dollars if not millions are spent by countries each year in restoring decayed teeth in addition to the numerous school/work hours that are lost (1). Yet dental caries is nearly preventable by oral hygiene techniques, diet counselling and fluoride therapy. Dental caries depends on presence of fermentable carbohydrates in the diet. Sucrose has been described as the “arch criminal” in the aetiology of caries (4). Analysis of data derived from the World Health Organisation’s Global Oral Health Epidemiologic Bank reveals a significant positive relationship ( $r=0.72$ ) between sugar supply and dental caries for 12-year-old children in 47 populations (5,6).

### 1.1.1 Epidemiology of Dental caries

Dental caries is still a major oral health problem in industrialised countries affecting 60-90% of school children and vast majority of adults (1). It is also the most prevalent oral disease in several Asian and Latin American countries but appears to be less common and less severe in African countries (1). In light of the changing living conditions, it is expected that the incidence of dental caries will increase in many developing countries in Africa, particularly as a result of the growing consumption of sugars and inadequate exposure to fluorides (1).

There is a geographical variation in caries experience as shown in the study by Pitts et al (7,8). Pitts et al. showed in 1996/97 that mean DMFT for 12-year-olds was less than 1.0 in the South, West and the Midlands whilst the rest of England, Wales and the Isle of Man had mean DMFT levels between 1.01 and 1.50. Higher

levels were seen in areas of Scotland and Wales (7). Pitts et al. again in 1998/99 also showed a mean DMFT of less than 1.5 in the South, West and Midlands whilst the rest of England, Wales and the Isle of Man had mean DMFT levels of between 1.5 and 2.25 (8).

Caries experience tends to increase with age (9, 10). Jose et al in a study among children in Kerala, India observed that there was an increase in the proportion of those children affected with dental caries as age advances (9). The same observations have been made by Varenne et al in his study on the oral health of children in Burkina Fasso. (10).

Sex differences in the prevalence of dental caries have been reported in several studies of 13-15-year-old children. A study conducted by Sogi in Davangere, India using DMFT/ DMFS score, reports a higher caries prevalence in females that was statistically significant (11). A study by Ng'ang'a et al among 13-15-year-olds in Nairobi, Kenya found higher mean DMFT of 1.9 in females as compared to 1.6 in males (12). This difference was statistically significant. However Manji et al. in a comparative study between Kenyan and Tanzanian children in 1988 found that there was no sex difference in caries experience among Kenyan children but a statistically significant sex difference is seen in Tanzanian children, with females being affected more than males (16).

Studies on dental caries have been done in Kenya since the early 1950's (13,14). However, the first detailed study on caries was done by Manji et al. in 1984 in Nairobi and the mean DMFT was found to be 0.2 with 88.3% of the children being

caries free (15). The study reported a decline of dental caries with increasing age. In a subsequent study, Manji et al. in 1988 found that the mean DMFT was 0.21 among rural 12 -year-olds (16). These results were comparable to earlier studies by the same author meaning that there was probably no difference in caries experience between rural and urban children. However, in the same study (16) a greater proportion of Kenyan children were caries free (87.4%) as compared to Tanzanian children (74.8%)  $p < 0.005$ . This later study agrees with current WHO oral health report that describes caries experience in Africa as less severe (1). Ng'ang'a et al in a study among 13-15-year-olds in Nairobi found the prevalence of caries to be 50% with a mean DMFT of  $1.8 \pm 2.2$  (12). In this study by Ng'ang'a et al, the prevalence of caries was higher than in studies previously done by Manji, since the former included pre-cavitation lesions and used a slightly older age group. These studies on caries experience demonstrate the haphazard nature of epidemiological studies in Kenya where different methodologies, sample population and sampling methods are used making it difficult to compare the results among different investigators. Further studies by Ng'ang'a et al. reported a mean DMFT of 1.9 among children from a pastoral community in Mandera, Kenya (17). Though the DMFT was higher than in previous studies, the age bracket of children examined was large and included 18-year-olds whose teeth had been exposed to cariogenic diets for a long time. Dattani (1997) reported dental caries prevalence of 37% and 12% for urban and rural 12-year-olds respectively (19). Ohito et al. in 1993 found no difference in caries experience between handicapped and normal children (18), however more comparative studies would be recommended to verify this observation. Ohito et al reported a mean DMFT was 0.8 and the prevalence of dental caries was 44%.



In one recent study, on dental caries in children in Kenya, Musera (20) observed that the prevalence of dental caries was 74.8% among rural 10-12-year-olds and this was higher than among urban children whose prevalence was 49.2%. The mean DMFT in this study was 1.246 for urban children and 2.724 for rural children. The DMFT for rural children was higher than what Ng'ang'a et al. found in 1993 among pastoralist children (17). The DMFT for urban children was also higher than the finding of Ng'ang'a et al. ( $1.8 \pm 2.2$ ) (12). However, the DMFT for urban children of 1.246 is almost similar to the DMFT of 12-year-old South African children which was reported to be 1.1 (21).

A few countries in Africa still have lower caries incidence among the 12-year-olds. A good example is Ethiopia where the prevalence is 21.1% (22). This is probably because the majority of Ethiopians still eat their staple diet (INJERA) made from traditional special flour or specially ground milled rice.

One of the limitations of studying dental caries in epidemiological studies is that not all lesions are diagnosed. Inter-proximal caries may not be diagnosed and, therefore, caries may be under-reported by as much as 40% as reported by Lesan (23).



### **1.1.2 Diet and dental caries**

Studies have shown that urban lifestyle influences the dietary patterns of a community and that dietary patterns, have an effect on the dental status of children. There has been an influx of cariogenic snacks into the Kenyan way of life and this could have contributed to the development of dental caries among school children (12). Ngatia et al. in a study of dietary patterns and dental caries among 3-5-year-olds found a higher prevalence of dental caries in children consuming sugary confectionaries (sweets, ice cream, biscuits and chocolate) compared to those who did not consume such products (24). However, the difference was not statistically significant.

## 1.2 GINGIVITIS

Periodontal diseases are defined as those which attack the supporting structures of teeth. There are two main types of periodontal diseases namely gingivitis and periodontitis. Chronic plaque associated gingivitis and periodontitis are destructive inflammatory diseases sometimes referred together as chronic periodontal disease. The term gingivitis is used to designate inflammatory lesions that are confined to the marginal gingivae. Once the lesions extend to include destruction of the connective tissue attachment of the tooth the disease is designated periodontitis. The causative factors of periodontal disease can be divided into two; local factors and systematic factors (25).

The principal local factor implicated in the aetiology of gingivitis is dental plaque. Dental plaque is defined as the soft deposits that form the bio film adhering to the tooth surface or other hard surface in the oral cavity. Bacteria in plaque & calculus initiate gingivitis by various mechanisms which include bacterial invasion, bacterial allergy and bacterial enzymatic activity. Dental calculus is an adherent calcified or calcifying mass that forms on tooth surfaces. Apart from its organic and inorganic components, it also contains bacteria similar to dental plaque in terms of composition and virulence. The combined chemical, bacterial and mechanical irritation (26) from calculus perpetuates gingival inflammation and leads to periodontal pocket formation (25). The periodontal pocket is an ideal area for bacterial growth and accumulation of debris and continued formation of calculus. Other deposits found on teeth include; materia-alba, mucinous plaque and protein pellicle. Berkneith and Williams demonstrated that material-alba contains toxins that may cause gingival inflammation (27).

### 1.2.1 Epidemiology of gingivitis

Epidemiological studies have shown the prevalence of gingivitis among children to be high (15, 20, 28, 30). Caranza's report from US national sample surveys 1986-1987 among 12-17-year-olds, reported a prevalence of 58.8% for gingivitis (25). Al Banyan et al found the highest reported prevalence of gingivitis of 100% among 5-12-year-old children in Riyadh Saudi Arabia (28). A study by Jose et al however revealed a very low prevalence of gingivitis of 15% among 12-15-year-old children in Kerala, India (9). Studies conducted in Africa have also revealed a high prevalence of gingivitis. Brindle et al conducted an oral health survey in Hlabisa, Kwazulu/Natal and found the prevalence of gingivitis to be 80% among 12-year-old children (29). Regionally in Ethiopia, a lower prevalence of gingivitis of 53.4% among 12-year-old children was found by Simon et al (22). In Dar-es-Salaam, Tanzania Mosha et al in a survey between 1979-1983 found that 99% of 7-14-year-old children suffered from gingivitis (30)

Few studies have been done on the prevalence of gingivitis among the 11-14-year-olds in Kenya. The general view is that amongst the older children, moderate levels of plaque may be encountered, but the prevalence of periodontal disease is low (31). Some people have a natural high resistance to disease and consequently low disease susceptibility. Such people have a low risk of acquiring periodontal disease (25). There are also high risk groups who have low host resistance and high disease susceptibility including patients with juvenile periodontitis and cyclic neutropenia (25). Manji et al. in 1984 reported the prevalence of gingivitis among

5-14-year-old children in Nairobi to be 92.1% (15). In contrast to the study by Jose et al among 12-15-year-old children in Kerala, India (9), Manji et al. reported that more males were affected by gingivitis than females (15). Butt in 1986 found out that 63.8% of patients between 10-14 years seen at Nyeri district hospital had periodontal disease (32). Ohito et al in 1997 found out that the prevalence of gingivitis among handicapped children was 37% compared to a prevalence of 41% among 11-13-year-old normal children (18). The prevalence of gingivitis was lower among handicapped children than among normal children in Kenya.

Jose et al showed an increase in the prevalence of gingivitis with increasing age in his study among 12-15 year old children in Kerala, India (9). The same study showed that females were more affected by gingivitis than males. Locally, Manji et al and Ohito et al reported similar observation of prevalence of gingivitis increasing with age among 5-14-year-old children in Nairobi (15,18). However, the gender distribution differed in the two studies. Manji reported that more males than females were affected by gingivitis whereas Ohito found that more females were affected than males.



### 1.3 ORAL HEALTH KNOWLEDGE, ORAL HYGIENE PRACTICES AND ORAL HEALTH SEEKING BEHAVIOUR

Several behavioural studies have shown a direct correlation between awareness and practices. Awareness of individuals regarding their periodontal health status when accompanied with knowledge about periodontal disease process, can help improve self oral health care and hence the prevention of periodontal diseases (33, 34, 35, 36). Oral hygiene is defined as those measures that are necessary to attain and maintain oral health, including practices required to cleanse teeth, the periodontal tissues and the mouth in general, thereby contributing to a state of cleanliness in the oral cavity (36). Oral hygiene plays an important role in the prevention of dental caries and periodontal disease. It has been shown severally that the degree of oral hygiene determines the absence or presence of dental caries (37, 38, 39). The patient's crucial role in oral hygiene involves actions against the factors that are indicated as very important in the development of dental caries especially dental plaque. The reduction or elimination of microbiota from the tooth surfaces by mechanical or chemical means is very important. Another objective of oral hygiene is to increase the resistance of the tooth and periodontal tissues against pathogenic micro-organisms for example, with the use of fluorides.

To date the most effective way of controlling plaque accumulation is by mechanical means (25, 40). This includes toothbrush and inter-dental cleansing aids such as the dental floss, wooden tips and rubber tips (25). It is necessary to establish the population's perceptions of oral health as it is from this that its promotion through education can succeed (41).

Oral health knowledge, attitude and behavior among Saudi school children in Jeddah showed that 87.1% of the 12-18-year-olds knew that tooth brushing helps to prevent periodontal disease (42). Only 33% knew that dental floss helps in preventing periodontal disease. In 2004 Okada et al. in a study among elementary school children, found out that parents' oral health behavior affected their children's oral health behavior (43). Okada noted that parents' oral health behavior also had a significant direct effect on their children's decayed teeth.

Very few studies on oral health knowledge and practices of children have been done in Kenya and East Africa. Masanja et al. in 2004 conducted a study to find out the knowledge on gingivitis and oral hygiene practices among secondary school adolescents in rural and urban Morogoro (44). This study found that secondary school teenagers have partial knowledge about gingivitis and a good knowledge of basic oral hygiene measures necessary to maintain proper oral health. However despite the fact that a large number of urban children (97%) thought it was necessary to brush teeth with toothpaste than rural (87%), most of the rural respondents knew why toothpaste was used (44).

Chindia et al. in 1992 in a study on oral health habits among university students, all the students said they brushed their teeth daily yet 35% of surfaces had plaque. This is a reflection of the gap between knowledge and practices of oral hygiene. In another comparative study by Kaimenyi et al, there were no consistent differences in oral health hygiene practices and dental health awareness between urban and peri-urban children (46). However, children from the urban schools brushed to

prevent decay while peri-urban children brushed for the purpose of preventing gum disease. For patients with severe plaque deposits, the toothbrush is more efficacious than the chewing stick in plaque control. However, for those patients with moderate plaque deposits, the chewing stick is as efficacious as the toothbrush in plaque control (47).

## 1.4 DENTAL HEALTH TREATMENT NEEDS

Oral health treatment needs are demands by the population for oral healthcare and in the context of this study includes demand for treatment of dental caries and inflammatory periodontal disease (48).

There is paucity of information on oral health treatment needs among 12-year-old children. Nalweyiso et al in a study on the dental treatment needs of children in a rural sub-county of Uganda found that 52.5% of the children needed a filling while 33% needed one or more teeth extracted (49). Al Banyan et al found that 41% of children aged 5-12-years-old in Riyadh, Saudi Arabia required treatment for dental caries in the permanent dentition (28). The author did not specify which type of dental treatment.

Data on treatment needs forms a basis for planning oral health programmes including estimating personnel requirements and the costs of an oral health programme under prevailing local conditions.



## 1.5 STATEMENT OF THE RESEARCH PROBLEM

Although epidemiological studies on dental caries have been conducted in Kenya, they may not reflect the current situation. Dietary patterns have been changing with urbanisation, modernisation and industrialisation in this country. There has been an increased marketing and consumption of western type sweet snacks in the Kenyan market which could contribute considerably to changes in the prevalence of dental caries and periodontal disease (24). While most studies on dental caries and gingivitis have been carried out in Nairobi which is an urban area, data for dental caries and periodontal disease amongst the rural populations in Kenya are scanty and have been collected and reported sporadically (31). Ng'ang'a et al in 1993 reported a low prevalence of dental caries in a study among children from a pastoralist community in Mandera district, Kenya (17). Hassanali et al reported finding only 10% of a sample of Maasai children living in Kajiado district to be suffering from dental caries in deciduous teeth (50). However, a recent study among rural 10-12-year-olds, Musera reported a higher prevalence of dental caries of 75% with 98.8% of the children suffering from gingivitis (20).

In all the epidemiological studies on dental caries and gingivitis carried out in Kenya among the 12-year-olds, the main objective was to find out the prevalence of the disease. No study has been conducted to specifically investigate the treatment needs for dental caries and gingivitis among 12-year-old children. There is a need, therefore, for national oral health survey to improve Kenya's data bank on these diseases.

This study investigated the prevalence of dental caries and gingivitis, the oral health knowledge and practices, and the overall treatment needs among 12-year-old in peri-urban Kitale using the WHO treatment needs index for dental caries and CPITN index (48). An evaluation of the knowledge and oral hygiene practices of 12-year-old children was also carried out and this will assist in planning of oral health education programmes in this region.

## 1.6 JUSTIFICATION OF STUDY

The period of adolescence which begins at the age of 12 years marks a time in which the role of the parent in the child's dental homecare is minimised; and the responsibility of the adolescent for managing his or her own oral health programme must be emphasized (3). A major concern is the fact that adolescents, particularly older ones who have access to money in the form of pocket money from their parents and some freedom to choose their own diet, may stray away from the diet that was maintained in their homes and adopt a regimen which includes increased consumption of snacks and the possibility of higher exposure to cariogenic diet.

At present there is limited information not only on the actual epidemiological profile of oral diseases but also on the nations oral health treatment needs. The prevalence of dental caries and gingivitis, and the oral health treatment needs among the 12-year-old children in peri-urban Kitale has never been investigated and this was a baseline study to investigate these two diseases. From an epidemiological and health services research point of view, it is important not only to establish the distribution of caries and gingivitis but also the overall treatment needs for these diseases.

It is hoped that results from the present study may be used in future to plan for the provision of dental services to children aged 12 years in Kitale municipality and peri-urban region.

## 1.7 OBJECTIVES

### 1.7.1 Broad objective

To assess the prevalence of dental caries, gingivitis and the dental treatment needs among 12-year-old children in peri-urban Kitale, Trans Nzoia district.

### 1.7.2 Specific objectives

1. To determine the prevalence of dental caries in 12-year-old children in peri-urban Kitale.
2. To describe the dental caries experience in 12-year-old children in peri-urban Kitale.
3. To determine the prevalence of gingivitis in 12-year-old children in peri-urban Kitale.
4. To describe the oral hygiene practices of 12-year-old children in peri-urban Kitale.
5. To describe the knowledge on aetiology and prevention of dental caries and periodontal disease among 12-year-old children in peri-urban Kitale.
6. To describe the treatment needs for dental caries and gingivitis among 12-year-old children in peri-urban Kitale.

## 1.8 HYPOTHESIS

1. There will be no gender differences in the prevalence of dental caries and gingivitis.
2. Knowledge and attitude on aetiology of dental caries and gingivitis has not influenced the prevalence of dental caries and gingivitis.



## CHAPTER 2

### MATERIALS AND METHODS

#### 2.1 STUDY AREA

Kitale municipality covering an area of 18 Sq. Km is the administrative centre for Trans Nzoia district. Trans Nzoia is the smallest of 14 districts of Rift Valley province. It is situated in western side of Kenya. It is bordered by Uganda to the west, Bungoma district to the south and Kakamega district to the north, West Pokot district to the east, Marakwet and Uasin Gishu districts to the South East.

Transnzoia has a highland equatorial type of climate with rainfall well distributed throughout the year. This type of climate is favourable for agriculture and livestock farming. The main agricultural produce is maize. Kitale town can therefore be classified as an agricultural town where economic activities revolve around maize farming in the peri-urban regions and sale of agricultural produce and inputs including tools and equipment and fertilizers, within the town centre.

Trans Nzoia districted is divided into six main administrative divisions namely:- Kwanza, Kiminini, Saboti, Central, Kapkoi and Cherengani divisions. Kitale town lies in the central division. Kitale has a total population of 86,262 people. It is a cosmopolitan type of population with most ethnic groups represented.

Approximately 50% of all health facilities in Trans Nzoia district are found in Kitale town. The town has the district hospital, one major private hospital (Mt Elgon Cottage) and several dispensaries. Dental services are only offered in two types of facilities namely the district hospital and by private dental clinics. The main form of

dental treatment at the district hospital is dental extraction, however, for those who can afford dental restorations, prosthetic work, orthodontics and minor oral surgical services are offered by the private dental practitioners.

Kitale municipality has 26 public schools and four educational zones namely: Grassland, Milimani, Bidii and Bondeni zones. More than 80% of the children attending municipal primary school in Kitale are drawn from the peri-urban areas. Therefore Kitale municipality is a town with a lot of influence from the rural, peri-urban areas. Kitale municipality is the only major town in Trans Nzoia district. Major radio and television stations are received by those with access to these facilities. Newspapers and magazines are readily available to the adolescents.

## 2.2 STUDY POPULATION

The study population was defined as 12-year-old children from public primary schools in Kitale Municipality, in Trans Nzoia district Rift Valley province. Newly transferred cases were not included.

## 2.3 STUDY DESIGN

This was a descriptive cross-sectional study using primary school based study groups.

## 2.4 VARIABLES

**Independent variables:** Gender, knowledge on dental caries and gingivitis, knowledge on aetiology and prevention of dental caries and gingivitis, oral hygiene practices.

**Dependent variables:** Dental caries; gingivitis, treatment needs.

## 2.5 SAMPLE SIZE DETERMINATION

In a previous study carried out in Meru South district in 2003 to determine dental caries in primary school children aged 10-12 years (20), 75% of rural children suffered from dental caries. Taking the proportion of children with dental caries to be 75%, the following formula was used in sample size determination as follows:

$$N = \frac{Z^2 Pq}{D^2}$$

N= Desired sample size (when population is greater than 10,000).

The confidence level chosen is 95%

Z= the standard normal deviate, was be set at 1.96 which corresponds to 95% confidence level.

P= Proportion of the target population estimated to have dental caries is 75%.

$$q = (1-P) = 1-0.75=0.25$$

D= Degree of accuracy desired was set at 0.05.

Then, the sample size N, was calculated as follows;

$$N = \frac{1.96^2 (0.75) (0.25)}{(0.05)^2} = 288$$

For this study 292, 12-year-old children were examined and this sample size was considered representative of 12-year-old children in peri-urban Kitale.



## 2.6 SAMPLING PROCEDURE

Kitale municipality has 26 public primary schools distributed in four educational zones namely; Bidii, Milimani, Grassland and Bondeni. All educational zones were included in the study. Schools were randomly selected from each of the four educational zones. For each zone all schools were listed down and two primary schools selected by simple random sampling.

The zones were represented by primary schools as follows;

- Bidii zone; Kijana Wamalwa and Makunga primary schools
- Milimani zone; Milimani and Show Ground primary schools
- Grassland zone; Masinde Muliro and St. Josephs primary schools.
- Bondeni zone; Township and Trans-Nzoia primary schools.

The number of children selected from each zone was based on the number of 12 year old children in that zone as a proportion of the total number of 12 year old children enrolled in public primary schools multiplied by the sample size. This followed that the different zones were represented as follows:

- Bidii zone =  $402/1668 \times 288 = 69$  pupils.
- Milimani zone =  $272/1668 \times 288 = 47$  pupils.
- Grassland zone =  $402/1668 \times 288 = 69$  pupils.
- Bondeni zone =  $592/1668 \times 288 = 102$  pupils.

Since two primary schools were selected from each zone, each school was represented by the number of children from that zone (as calculated above) divided

by two. Therefore, 35 children per school were selected from Bidii and Grassland zone, 24 from Milimani zone and 51 from Bondeni zone.

The procedure for selecting the children to participate in the study was similar for all the four zones. Based on the school records, majority of the 12-year-old children were found in standard 5, 6 and 7. All the 12-year-old children were given consent forms through school administration to take to their parents/ guardians for consent and bring them back to school. For each school a list of all 12 year old children with consent from parents was made using class attendance registers of standard 5, 6 and 7. Every second 12-year-old child was examined from this list.

## 2.7 INCLUSION CRITERIA

1. All children aged 12 years +/- 6 months as at October 2005.
2. Children with consent from parents or guardians.
3. Children who assented to the study.

## 2.8 EXCLUSION CRITERIA

1. Children without consent were excluded.
2. Children who were not 12 years +/- 6 months as at October 2005.
3. Children who were too ill to be examined.

## 2.9 DATA COLLECTION

### **Data collection instruments and procedure**

Two field assistants were selected and trained on how to record results of oral examination and on disinfection and sterilization of dental instruments used. An electric autoclave and cidex (glutaraldehyde) were used to sterilize instruments. Soiled instruments were washed with soap and water then soaked in cidex for 30 minutes. The instruments were then rinsed with adequate water and put in an autoclave preset at 135 degrees for 30 minutes.

Structured questionnaires (appendix 1) were administered to assess oral health knowledge and practices prior to clinical examination. Before the study the questionnaires were pre-tested and validated using 12-year-old children from Unity primary school in Nairobi. The children in Kitale answered the questionnaires in classrooms. There were 6 questions on the knowledge of these children concerning dental caries and gingivitis which were filled in as part of the questionnaire. These questions were adopted from a study by Kaimenyi et al titled, "Oral hygiene habits and dental health awareness of Kenyan children aged 9-15 years in peri-urban and urban schools" published in 1993 (46).

Intra-oral examination was carried out by the investigator (ROO) under natural light in a classroom with the child seated on a classroom chair. Gingivitis and treatment need was assessed using CPITN index. A graduated periodontal probe was used to examine the gingival health of the children. The index teeth were 16, 11, 26, 36,

31 and 46, and these were assessed for gingival bleeding and calculus adherent on the tooth. Dental caries was assessed using the 1997 WHO oral health survey methods (48). WHO data collection form (appendix 2) was used to assess for dental caries and each tooth was recorded as either decayed (D), missing due to decay (M) or filled (F). A dental probe was used to check for caries after drying the tooth with cotton gauze. Missing teeth were confirmed from the child that they were extracted due to dental caries. Teeth were isolated and dried using gauze. Examination was done using a dental mirror and dental probe. Extent of caries to dentine and pulp was also determined by clinical examination. Data obtained from clinical examination was entered in the WHO data collection form (appendix 2). Before data collection the principal investigator was calibrated by one supervisor and 15 children were examined. The inter-examiner agreement was 0.82 for dental caries and 0.805 for gingivitis. During data collection, 29 children were re-examined to determine intra-examiner variability. The Kappa values obtained were 0.87 for dental caries and 0.81 for gingivitis which show good consistency and minimal variability.



## 2.10 DATA ANALYSIS

Data was analyzed using SPSS computer software with the help of a biostatistician. Data cleaning was done by running frequencies and errors in data collection were corrected by going back to data collection forms. Descriptive statistics which involved measures of central tendency, dispersion and proportions for was used to analyze categorical variables. The mean, mode and median values were computed for decayed, missing, filled teeth, oral health knowledge and gingival index. Chi square test was used to determine associations between oral health practices and gender (proportions) and oral health seeking behavior between males and females. Mann Whitney U Rank test was used to test differences between oral health practices and dental caries/gingivitis for 2 groups and where there were 3 groups Kruskal Wallis was used to compare the differences.



## 2.11 LIMITATIONS OF THE STUDY

1. Structured questionnaire: though it simplifies analysis it limits expression of the respondents. Thus it may increase possibilities of errors when answering questions
2. Possibility of errors when answering questions. Some students may have guessed the answers they didn't know.
3. Absence of radiographs
4. Possibility of error on the part of the child in determining cause of extractions.

## 2.12 ETHICAL CONSIDERATIONS

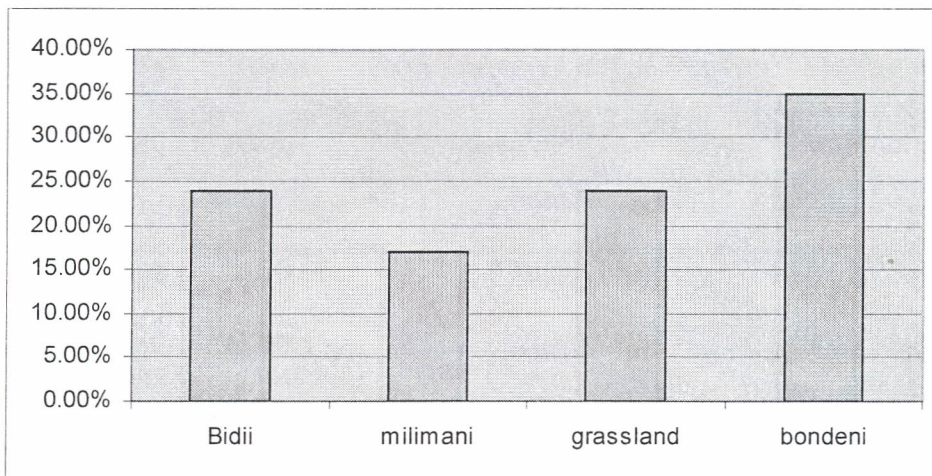
1. Study was conducted only after approval from Kenyatta National Hospital/University of Nairobi Ethics and Research Committee (Appendix 3).
2. Consent was sought from the children's parents or guardians (Appendix 4).
3. The children identities were kept confidential
4. Participation in the study was voluntary
5. Cases requiring emergency treatment were promptly referred to Kitale District Hospital
6. Clinical examination was non-invasive and was under strict aseptic conditions.
7. Efforts were made to avoid causing pain during examination, eg. Gentle probing.
8. Results from this study will be communicated to municipal council health authorities for action.
9. Results of this study will be published so that it is available for use to the benefit of all children.

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## CHAPTER 3: RESULTS

### 3.1 DEMOGRAPHIC CHARACTERISTICS

A total of 292 children aged 12 years were examined. There were 140(47.9%) boys and 152(52.1%) girls. The children examined were distributed according to the educational zones (figure 1).



*Figure 1; Distribution of children according to educational zones;*

## 3.2 DENTAL CARIES

### 3.2.1 Dental Caries Prevalence

The overall prevalence of dental caries was 50.3% and this included both permanent and deciduous teeth. Males were almost equally affected as females. Therefore the null hypothesis that there will be no gender difference in the prevalence of dental caries was accepted. The prevalence of dental caries when deciduous and permanent teeth were considered is shown in table 1.

*Table 1; Prevalence of dental caries among 12-year-old children*

Caries	Male	Female	Total
Presence of caries	71(50.9%)	76(50.0%)	147(50.3%)
Absence of caries	69(49.1%)	76(50.0%)	145(49.7%)
Total	140(100%)	152(100%)	292(100%)

### 3.2.2 Dental caries experience

The overall mean DMFT was 0.92 (SD 1.36). Females had a higher caries experience (DMFT) than males and the difference was statistically significant  $p < 0.05$  ( $p = 0.042$ ) as shown in table 2.

Table 2; Dental Caries experience according to Gender among the 12-year-old children

Gender	DMFT	Mann Whitney U Test
Male	0.76(SD1.23)	1.219; $p < 0.05$ (0.042)
Female	1.07(SD)1.45	Significant difference

The decayed component accounted for 95.5% of DMFT, while teeth missing due to decay accounted for 4.5%. There were no filled teeth in these children. The distribution of the decayed missing and filled components of DMFT are shown in figure 2.

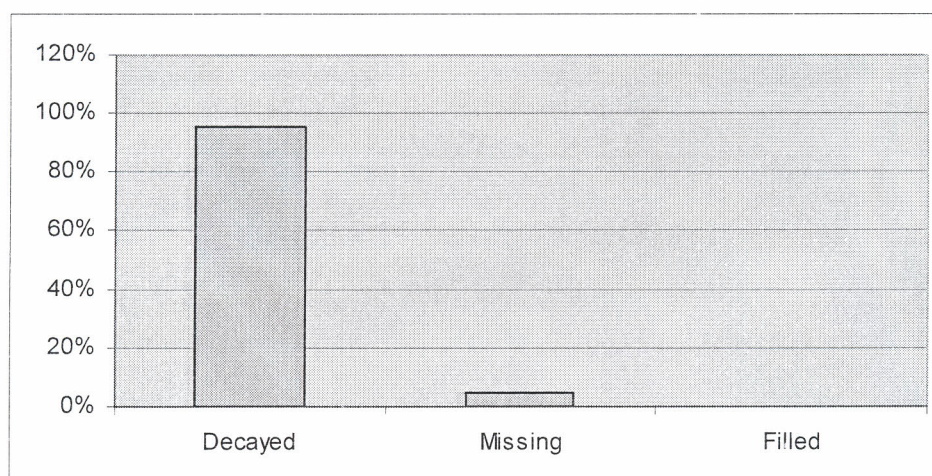


Figure 2; Distribution of the various components of the DMFT



There were 162 children (55.5%) who were caries free. Only 16 children (12.2%) had a DMFT of greater than 3. Considering that 55.5% of the children were caries free therefore the prevalence of dental caries on permanent dentition was 44.5%. Distribution of children according to DMFT score is shown in table 3 below.

*Table 3; Percentage distribution of DMFT in the 12-year-old children*

<b>DMFT</b>	<b>Frequency</b>	<b>Percent %</b>
0	162	55.5
1	56	19.2
2	38	13.0
3	20	6.8
4	10	3.4
5	2	0.7
6	2	0.7
7	1	0.3
8	1	0.3
TOTAL	292	100

The mandibular first permanent molar was the most commonly decayed tooth. The lower anterior sextant did not have any decayed tooth (table 4).

Table 4: Pattern of Tooth Decay according to tooth type in the 12-year-old children

\*Maxillary Permanent teeth

Tooth	17	16	15	14	13	12	11
Decayed	10 (3.6%)	30 (10.9%)	3 (1.1%)	2 (0.73%)	0 (0%)	0 (0%)	0 (0%)

Tooth	21	22	23	24	25	26	27
Decayed	1 (0.36%)	0 (0%)	1 (0.36%)	1 (0.36%)	1 (0.36%)	25 (9.1%)	9 (3.1%)

\* Mandibular Permanent teeth

Tooth	47	46	45	44	43	42	41
Decayed	27 (9.8%)	56 (20.36%)	4 (1.40%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

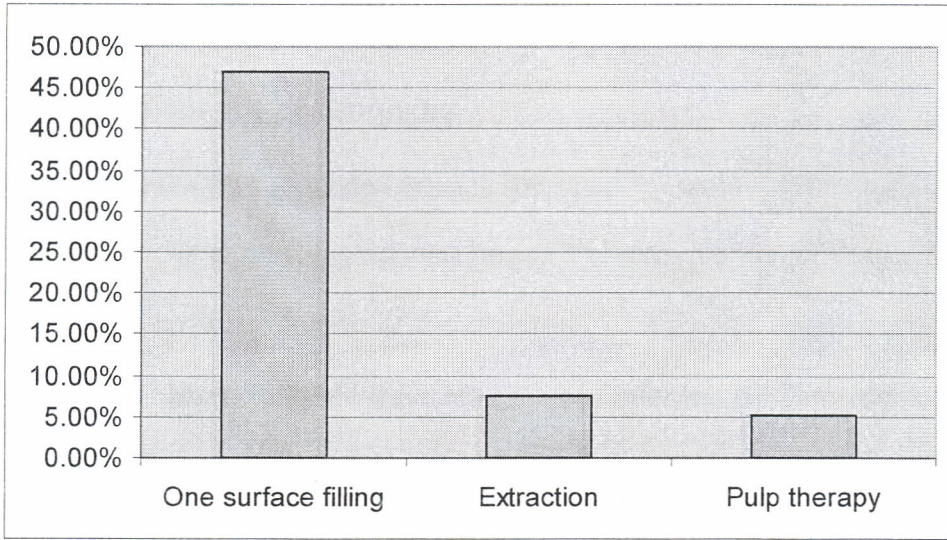
Tooth	31	32	33	34	35	36	37
Decayed	0 (0%)	0 (0%)	0 (0%)	3 (1.1%)	8 (2.91%)	62 (22.54%)	32 (11.64%)

### 3.2.3 Dental caries treatment needs

Majority of the children (46.9%) required at least one surface restoration on their permanent teeth. Very few children required pulp therapy (5.1%) and extraction of teeth (7.5%). There was no statistically significant difference in the treatment needs between male and female children ( $p > 0.05$ ). The dental treatment needs are summarised in table 5 and figure 3.

*Table 5: Dental Caries Treatment need among the 12 year-old-children*

Treatment need	Male	Female	Total	Statistical test
One surface filling	61(43.6%)	76(50.0%)	137(46.9%)	$X^2 = 0.059$ ; 1df $P > 0.05$ (0.808)
Extraction	10(7.1%)	12(7.9%)	22(7.5%)	$X^2 = 1.209$ ; 1df $P > 0.05$ (0.271)
Pulp therapy	8(5.7%)	7(4.6%)	15(5.1%)	$X^2 = 0.184$ ; 1df $P > 0.05$ (0.668)



*Figure 3; Dental caries treatment needs among 12-year-old children*

### 3.3 GINGIVITIS

#### 3.3.1 Prevalence of Gingivitis

The prevalence of gingivitis among the children examined was 77.7%. Only 22.3% did not show signs of gingivitis hence the prevalence of gingivitis calculated as 77.7%. A small proportion of the children (10.6%) had all the six sextants with CPI score of 1. More females than males were affected by gingivitis but the difference was not statistically significant ( $p>0.05$ ) as shown in table 6. Therefore the null hypothesis that there will be no gender difference in the prevalence of gingivitis was accepted.

*Table 6; Distribution of children according to sextants with CPI score of 1*

<b>Sextant</b>	<b>Male</b>	<b>Female</b>	<b>Total</b>
0	28(43.1%)	37(56.9%)	65(22.3%)
1	10(66.7)	5(33.3%)	15(5.1%)
2	27(48.2%)	29(63.0%)	56(19.2%)
3	17(37.0%)	29(63.0%)	46(15.8%)
4	29(50.0%)	29(50.0%)	58(19.9%)
5	13(61.9%)	8(38.1%)	21(7.2%)
6	16(51.6%)	15(48.4%)	31(10.6%)
Total	140(47.9%)	152(52.1%)	292(100%)



There were 38.7% of the children with CPI score of 2. This represents those children who had calculus or other plaque retentive factors. Only 2.1% of the children had all the quadrants affected by plaque retentive factors (table 7).

*Table 7; Distribution of children according to sextants with CPI score of 2*

<b>Sextant</b>	<b>Male</b>	<b>Female</b>	<b>Total</b>
0	86(48.0%)	93(52.0%)	179(61.3%)
1	19(50.0%)	19(50.0%)	38(13.0%)
2	23(45.1%)	28(54.9%)	51(17.5%)
3	5(33.3%)	10(66.7%)	15(5.1%)
4	2(100.0%)	0(0.0%)	2(0.7%)
5	1(100.0%)	0(0.0%)	1(0.3%)
6	4(66.7%)	2(33.3%)	6(2.1%)
Total	140(47.9%)	152(52.1%)	292(100%)

### 3.3.2 Periodontal treatment needs

A large proportion of the children (77.7%) required oral hygiene instructions, 38.7% required professional dental care (full mouth scaling) while 22.3% did not require treatment. The periodontal treatment needs are summarised in table 8 and figure 4 below.

Table 8; Treatment needs for gingivitis according to gender among the 12-year-old children

TREATMENT NEED	MALE	FEMALE	TOTAL
Oral hygiene instructions	112(49.3%)	115(50.7%)	227(77.7%)
Full mouth scaling	54(47.8%)	59(52.2%)	113(38.7%)

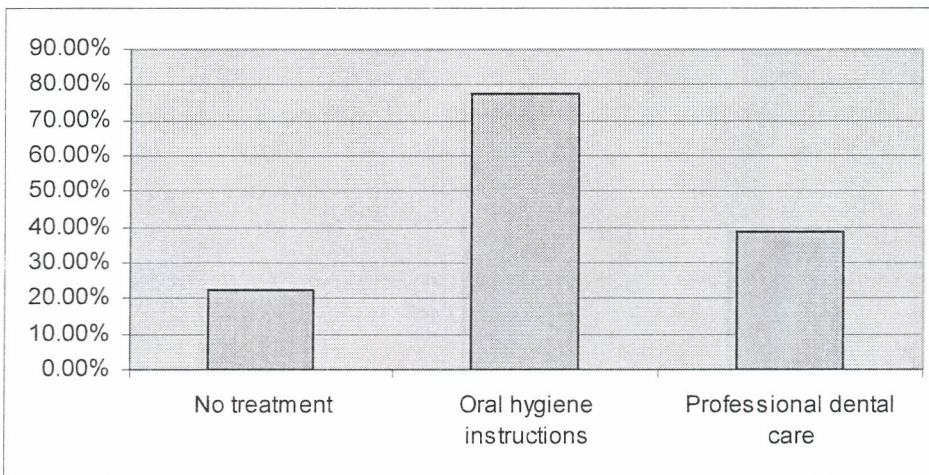


Fig 4; Treatment needs for gingivitis among 12-year-old children

The caries experience was higher in those children who had gingivitis (CPITN>0) than those who did not have gingivitis (CPITN=0) but the difference was not statistically significant  $p>0.05$  ( $p=0.082$ ) as shown in table 9.

*Table 9; Relationship between gingivitis and dental caries experience*

	CPITN=0	CPITN>0	Statistical test
DMFT	0.89(SD 1.201)	0.93(SD 1.400)	Mann Whitney U test Z=-1.742;p>0.05(0.082)

### 3.4 ORAL HYGIENE PRACTICES

Majority of the children 197(67.5%) brushed their teeth. Majority of the children 109(55.3%) brushed their teeth three times a day (table 10). Most of the children 104(52.8%) started brushing their teeth before primary school, while 53(26.9%) started brushing their teeth in primary school. A small number of children 29(14.7%) did not remember when they started brushing their teeth. There was no statistically significant difference in oral hygiene practices between males and females. Oral hygiene practices are shown in table 10 below.

*Table 10; Oral hygiene practices of 12-year-old children*

VARIABLE	MALE	FEMALE	TOTAL	STATISTICAL TEST
Brushing				$X^2 = 0.787; 1df$
Yes	98(70.0%)	99(65.1%)	197(67.5%)	
No	42(30.0%)	53(34.9%)	95(32.5%)	$P > 0.05 (0.375)$
Frequency of brushing				Test could not be carried out.
Once	28(28.6%)	17(17.2%)	45(22.8%)	
Twice	16(16.3%)	27(27.3%)	43(21.8%)	
Thrice	54(55.1%)	55(55.5%)	109(55.3%)	
When brushing started				$X^2 = 2.191; 3df$
Before primary school	49(50.0%)	55(55.6%)	104(52.8%)	
In Primary school	28(28.6%)	25(25.3%)	53(26.9%)	$P > 0.05 (0.534)$
This year	4(4.1%)	7(7.1%)	11(5.6%)	
Don't remember	17(17.3%)	12(12.1%)	29(14.7%)	



Out those children who brushed their teeth, 127(64.5%) used a tooth brush, 33(16.8%) used mswaki and 32(16.2%) used both tooth brush and mswaki (table 11). Out those who brushed their teeth, 173(87.8%) used tooth paste while 24(12.2%) did not use tooth paste (table 11). There was no statistically significant difference in the use of toothpaste between males and females.

Table 11; Oral hygiene aids of 12-year-old children

VARIABLE	MALE	FEMALE	TOTAL	STATISTICAL TEST
Brushing implement				Test could not be carried out.
Mswaki	19(19.4%)	14(14.1%)	33(16.8%)	
Toothbrush	64(65.3%)	63(63.6%)	127(64.5%)	
Toothbrush & Mswaki	12(12.2%)	20(20.2%)	32(16.2%)	
Tooth pick	3(3.1%)	2(2.0%)	5(2.5%)	
Use of Toothpaste				$X^2 = 0.214; 1df$
Yes	85(86.7%)	88(88.9%)	173(87.8%)	$P > 0.05 (0.644)$
No	13(13.3%)	11(11.1%)	24(12.2%)	

About 80% of those children who did not brush said they could not afford tooth paste, 10% did not know people brush while less than 10% thought it was not helpful. Reasons for not brushing are shown in figure 5 below.

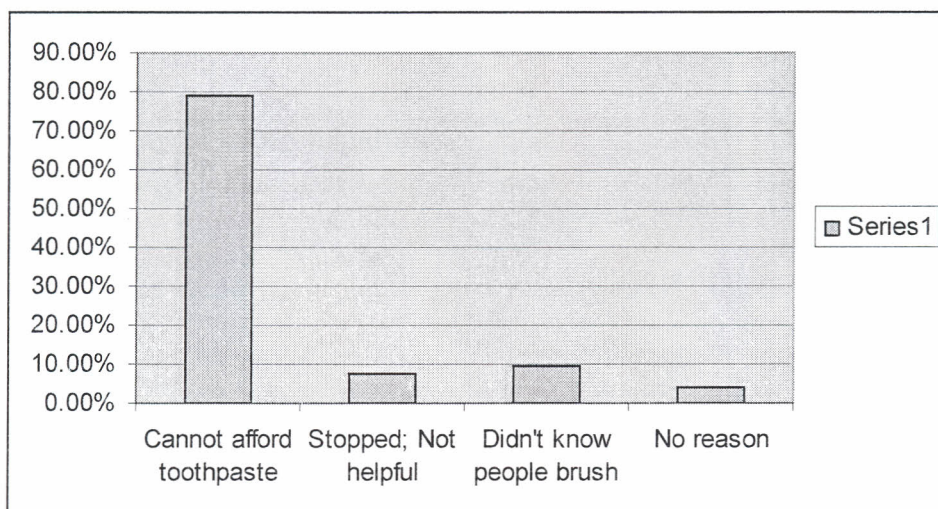


Figure 5; Reasons for not brushing teeth according to the 12-year-old children



Brushing of teeth and frequency of brushing did not influence the caries experience among these 12-year-old children. However, those children who brushed their teeth with toothpaste had a higher caries experience than those who did not use toothpaste and the difference was statistically significant,  $p < 0.05$  as shown in table 12.

*Table 12; Relationship between oral hygiene practices and dental caries experience*

<b>Variable</b>	<b>DMFT +/-</b>	<b>Statistical test</b>
<b>Brushing teeth</b>		Mann Whitney U test.
Yes	0.94(SD 1.36)	$Z = -0.087; p > 0.05$
No	0.88(SD 1.35)	(0.930)
<b>Use of tooth paste</b>		Mann Whitney U test.
Yes	1.02(SD 1.410)	$Z = -2.328; p < 0.05$
No	0.33(SD 0.702)	(0.020)
<b>Frequency of tooth brushing</b>		Kruskall-Wallis test
Once	0.59(SD 1.141)	$\chi^2 = 3.796; 2df$
Twice	1.21(SD 1.597)	$P > 0.05 (0.150)$
Thrice	0.99(SD 1.344)	

There was no statistically significant difference in the prevalence of gingivitis between those children who brushed their teeth and those who did not  $p > 0.05$  ( $p = 0.578$ ) (table 12).

There was no statistically significant difference in the prevalence of gingivitis between those children who brushed their teeth once, twice or thrice a day  $p > 0.05$  ( $p = 0.490$ ) (table 12).

There was no statistically significant difference in the prevalence of gingivitis between those children who brushed their teeth with toothpaste and those who did not  $p > 0.05$  ( $p = 0.553$ ) (table 13).

*Table 13; Relationship between oral health practices and gingival health among 12-year-old children*

Oral Hygiene Practices	CPITN = 0	CPITN > 0	Statistical test
Brushing			
Yes	42(64.6%)	155(68.3%)	$\chi^2 = 0.309$ ; 1df
No	23(35.4%)	72(31.7%)	$P > 0.05$ (0.578)
Frequency of brushing			
Once	15.0%	21.9%	$\chi^2 = 1.429$ ; 2df
Twice	20.0%	23.2%	$P > 0.05$ (0.490)
Thrice	65.0%	55.0%	
Use of toothpaste			
Yes	38(90.5%)	135(87.1%)	$\chi^2 = 0.353$ ; 1df
No	4(9.5%)	20(12.9%)	$P > 0.05$ (0.553)

### 3.5 ORAL HEALTH SEEKING BEHAVIOUR

Less than half of the children, 36.3% had visited the dentist before and there was no difference in the oral health seeking behaviour between males and females  $p > 0.05$  ( $p = 0.657$ ). Most of the children (18.2%) who visited the dentist went for tooth extraction, 6.8% for tooth cleaning and 4.1% for filling. A very small number of children (5.1%) went for check up. Oral health seeking behaviour is summarised in table 14.

*Table 14; Oral health seeking behaviour of 12-year-old children*

VARIABLE	MALE	FEMALE	TOTAL	STATISTICAL TEST
Ever visited a dentist				$X^2 = 0.197; 1df$
Yes	49(35.0%)	57(37.5%)	106(36.3%)	$P > 0.05 (0.657)$
No	91(65.0%)	95(62.5%)	186(63.7%)	
Reason for visiting				$X^2 = 8.67; 4df$
Extraction	30(60.4%)	23(41.4%)	53(18.2%)	$P > 0.05 (0.070)$
Tooth cleaning	10(20.8%)	10(17.2%)	20(6.8%)	
Filling	5(10.4%)	7(12.1%)	12(4.1%)	
Check up	2(4.2%)	13(22.4%)	15(5.1%)	
Other	2(4.2%)	4(6.7%)	6(2.1%)	

Majority of the children (84%) who had visited the dentist before would have wanted to be seen again as shown in figure 5.

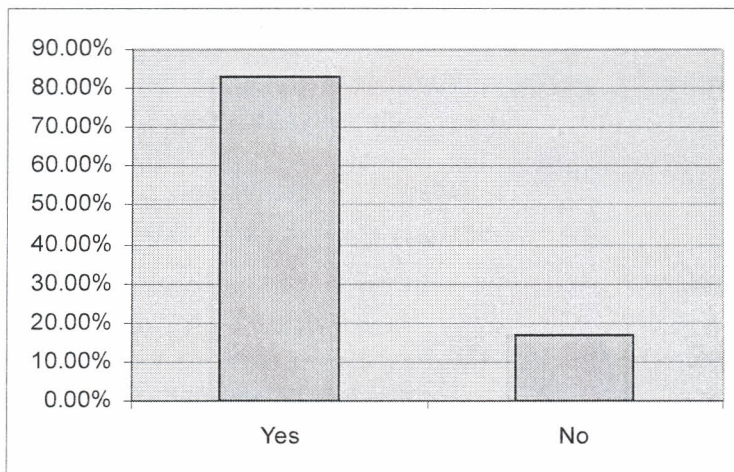


Figure 6; Distribution of 12-year-old children according to whether they would want to see the dentist again

Among those children who would not have wanted to see the dentist again, 50% said it was a painful experience, 38.9% could not afford and 11.1% said dentist keeps removing teeth. Reasons for not wanting to see a dentist again are summarised in figure 6.

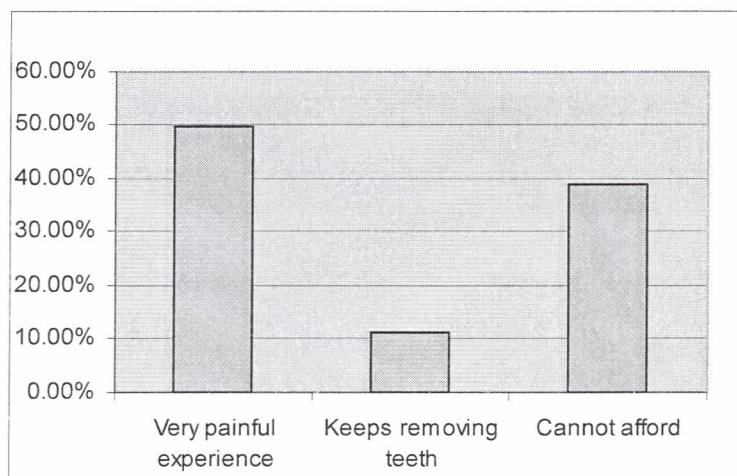


Figure 7; Reasons for not wanting to see the dentist again



There was no statistically significant difference  $p > 0.05$  ( $p = 0.210$ ) in the caries experience between the children who had visited the dentist before and those who had not as shown in table 15.

*Table 15; Relationship between oral health seeking behaviour and dental caries experience among 12-year-old children*

Oral health seeking behaviour	DMFT	Statistical test
<b>Visited Dentist</b>		Mann Whitney U test.
Yes	1.09(SD1.58)	$Z = -1.254$ ; $p > 0.05$
No	0.82(SD1.20)	(0.210)

There was no statistically significant difference in the prevalence of gingivitis among the children who had visited the dentist before and those who had not  $p > 0.05$  ( $p = 0.862$ ) as shown in table 16.

*Table 16; Relationship between oral health seeking behaviour and prevalence of gingivitis among 12-year-old children*

Visited Dentist	CPI=0	CPI>0	Statistical test
Yes	23(35.4%)	83(36.6%)	$\chi^2 = 0.030$ ; 1df
No	42(64.6%)	144(63.4%)	$P > 0.05$ (0.862)



### 3.6 ORAL HEALTH KNOWLEDGE

Majority of the children (69.9%) had moderate oral health knowledge. Very few children (8.9%) had poor knowledge. Oral health knowledge is summarised in table 17

*Table 17; Oral Health Knowledge among 12-year-old children*

Knowledge scores	Frequency	Percent %
Poor	26	8.9
Moderate	204	69.9
Good	62	21.2
Total	292	100

The children who had poor knowledge had a higher caries experience than those who had moderate and good knowledge though the difference was not statistically significant  $p > 0.05$  ( $p = 0.526$ ) as shown in table 18. Therefore accept null hypothesis.

*Table 18; Oral Health Knowledge verses caries experience among 12-year-old children*

Knowledge Score	DMFT	Statistical Test
Poor	1.23(SD1.818)	Kruskall-Wallis test $\chi^2 = 1.286; 2df$ $P > 0.05 (0.526)$
Moderate	0.88(SD1.203)	
Good	0.94(SD1.598)	

Most of the children (74%) would have wanted the dentist to remove their teeth as shown in figure 8.

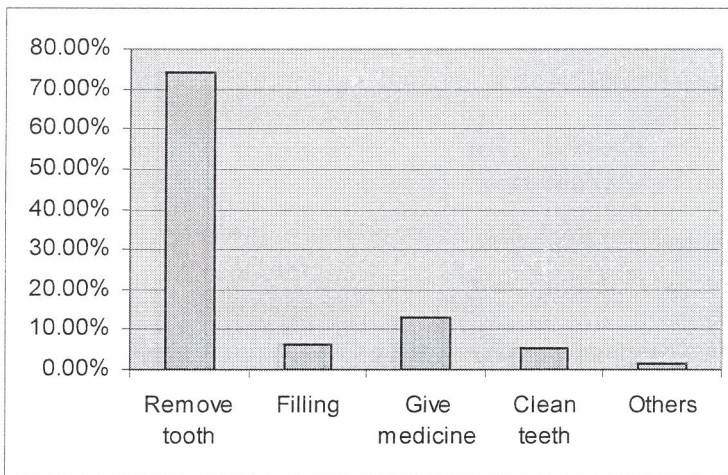


Figure 8; Response to the treatments the 12-year-old children would prefer if they visited the dentist

Most of the children (86%) thought tooth decay is caused by eating sweets, 25.7% thought decay was caused by bacteria and 2.1% thought brushing teeth would cause decay. Responses to causes of tooth decay are summarized in figure 9.

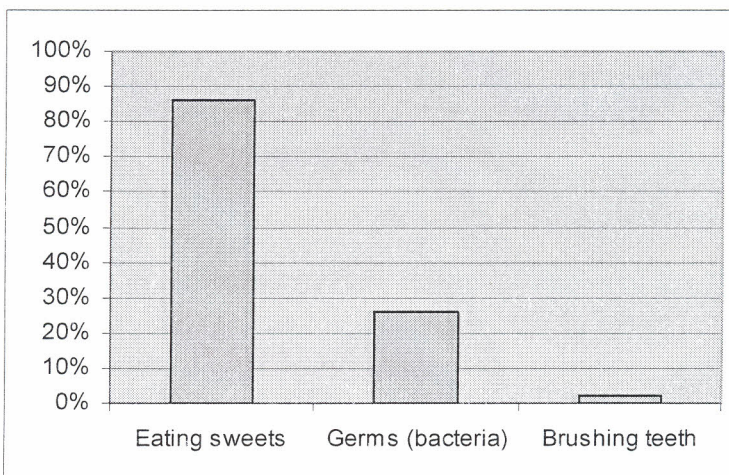


Figure 9; Response to causes of tooth decay according to the 12-year old children

Majority of the children 85.3% thought dental caries could be prevented while only 14.7% said it was not preventable as shown in figure 10.

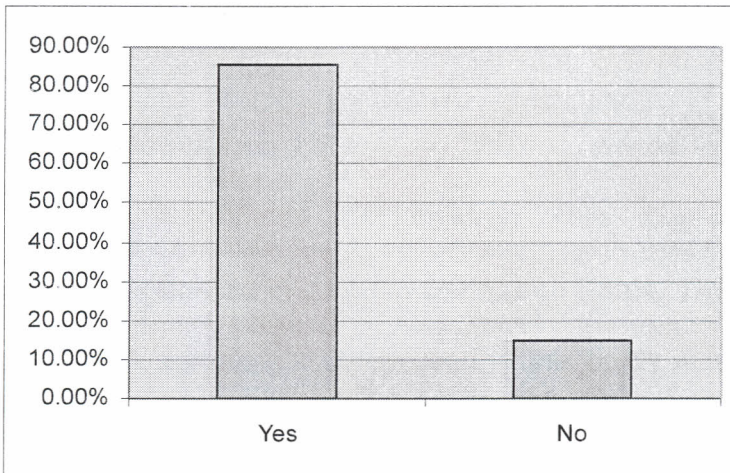


Figure 10; Response to whether tooth decay is preventable according to 12-year-old children

Most of the children (50.3%) thought dirt on teeth causes bleeding gums, 25.7% thought bacteria on teeth and 19.2% failure to brush (figure 11).

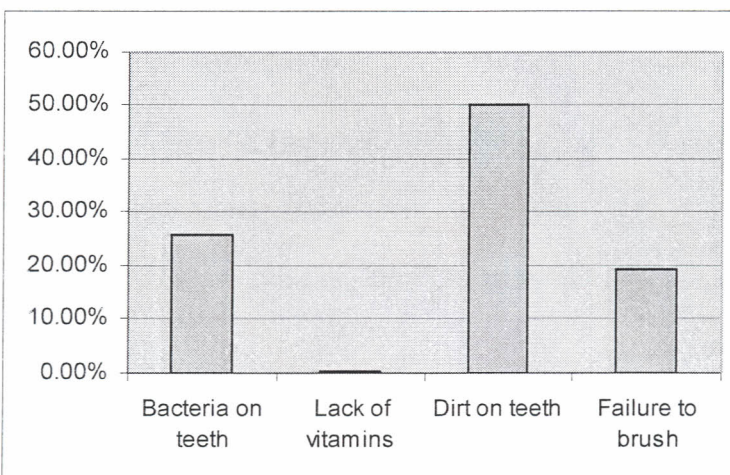


Figure 11; Response to what causes bleeding gums according to 12-year-old children



## CHAPTER 4: DISCUSSION

### 4.1 DEMOGRAPHIC CHARACTERISTICS

This study was carried out on 12 year old children, whose age was verified from the class register. A total of 292 children were examined and this was representative of 12-year-old children in peri-urban Kitale. The gender distribution was near equal. The sampling method used in this study was multistage random sampling and this was a representative of the 12-year-old children in the municipality.

### 4.2 DENTAL CARIES

Dental caries was recorded using the WHO dental caries assessment form (48). The children were either in late mixed dentition or permanent dentition. Majority had the second permanent molars erupted. Deciduous teeth were not analyzed in this study because of several reasons; less than 3% of the children had deciduous teeth, majority of deciduous were near exfoliation and it was also difficult to ascertain whether they were missing due to caries or natural exfoliation.

The overall prevalence of dental caries including both deciduous and permanent dentition was 50.3%. However since the analysis in this study was based on the permanent dentition, therefore, the prevalence of dental caries in permanent dentition was found to be 44.5%. This is a high prevalence since it suggests that

about half of the 12-year-old children who were examined were affected by dental caries. This prevalence was higher than has been reported in previous studies amongst children in Nairobi. Manji (1988) found a prevalence of 22.6% among 12 year olds (22.6%) in Nairobi (16). Dattani (1997) reported prevalence of 37% and 12% for urban and rural 12-year-old children respectively in Kenya (19). However, the prevalence of caries in this study was not different from that reported by Ng'ang'a et al of 50% among 13-15-year-old children in Nairobi (12). The prevalence of dental caries found in this study is also similar to that found by Musera et al among 12-year-old children in Nairobi which was 49.2% (20). The prevalence of caries in this study was however lower than what Musera et al found in the same study among rural 10 to 12-year-olds in Meru South district which was unusually high at 74.8% (20). These findings may be interpreted in two ways, either, the prevalence of dental caries in children in Kenya may be on the increase or there could be geographical/regional variation in the prevalence of dental caries as implied by Pitts et al (7, 8). However the sample size and diagnostic criterion in this study may have been different from the previous studies and therefore conclusions and comparisons cannot be made conclusively. There was no statistically significant difference in the prevalence of dental caries hence the null hypothesis was accepted.

The caries experience was low with mean DMFT of 0.92(SD1.36). The DMFT in this study was well within the WHO recommended global average for dental caries for the year 2000. This caries experience in this study may fall within the WHO global goals for oral health 2020, although the recommendations are that the oral health goals should be tailored according to the epidemiology of oral diseases,



political, socio-economic, cultural and legislative context of the given population (51). The caries experience was much lower than Musera's findings in both rural and urban children (20), and was also lower than the findings by Ng'ang'a et al (12). This population may be difficult to define as urban or rural. Though these children attend school in the town, 80% of the children live in their rural small scale farms outside the municipality (personal communication with District Education Officer). Therefore a possible explanation of the low caries experience may be attributed to low socio-economic status of the peasant farmers and the relative inability of these families to access and routinely indulge in cariogenic snacking. Manji reported low prevalence of caries in children from low socio-economic status homes as compared to those from high socioeconomic status (52). Socioeconomic status has an influence on the pattern of cariogenic snacking (53). The fluoride levels in Kitale were not determined and therefore its influence on the prevalence of dental caries was not investigated.

The decayed teeth had the greatest contribution to the caries experience (DMFT). The decayed component accounted for 95.5% of the DMFT, missing due to decay accounted for 4.5% and there were no filled teeth. The level of untreated tooth decay is therefore high among the 12-year-old children who were examined in Kitale. Untreated tooth decay in adolescents has been shown to reflect low utilization of preventive dental services and may be a result of limited access to dental care or dental avoidance by parents and their children (54). Other reasons for untreated tooth decay include lack of awareness by the parents and low socio-economic status. More recently the National Oral Health Policy document has indicated that the dental clinics in most government hospitals are poorly equipped

and understaffed (55). There is only one dentist attending to the whole district and the dental equipments are in deplorable state (personal communication with District Medical Officer of Health). Dental restorative services are lacking and the only curative service available is dental extraction. Dental restorative work in Kitale is only available at the private practitioner's clinic at a fee that may not be affordable to the parents of the children examined. There is also lack of adequate medical personnel to carry out oral health promotion and preventive services in Kitale municipality (55).

The caries experience was higher in females (DMFT 1.07) than males (DMFT 0.76) and the difference was statistically significant  $p < 0.05$ . This observation has also been reported in other studies carried out among children in Kenya (11, 12, 16). Although strong conclusions can not be made on the reasons for this, it has been suggested by Ng'ang'a et al that females may probably be involved in more cariogenic habits than males (12). The eruption time of teeth in females occurs earlier than males by up to 10 months as described by Manji et al (56) and Hassanali et al (57) and this could be a contributory factor as teeth in girls are exposed to the risk factors of caries much earlier. This should be investigated in future studies.

The first permanent molars had the highest caries incidence, and this was more in the mandibular molars than maxillary molars. The clinical crown morphology of these teeth including the occlusal grooves, pits and fissures are thought to make these teeth more susceptible to decay. The occlusal pits and fissures act as plaque retentive areas. Another factor that may make these teeth more prone to decay is

the fact that they are the first permanent teeth to erupt hence are exposed to the oral cavity at an earlier time compared to the other teeth. Several other studies have demonstrated that the occlusal surface of the first permanent molar is the site in the dentition which is most frequently attacked by dental caries (58, 59). This finding supports fissure sealing of newly erupted first molars as a preventive measure since they are prone to dental caries.

Majority of the children (46.9%) required one surface restoration, 5.1% required pulp treatment while 7.5% required extractions. These treatment needs are higher than what was reported in Uganda where 30.2% of the children needed a filling while 6.4% required an extraction (49). This information suggests high demand for restorative services. Since majority of the children required one surface restoration, ART may be a viable option of treatment for these children. The poorly equipped dental facility in Kitale municipality and the scarcity of dentists justify the introduction of this ART which has been shown to have an improved 3 year survival rate (60, 61, 62). Most studies report a 3 year survival rate of ART restorations to be between 79% and 88% which is comparable to that of one surface amalgam restoration (61, 62). In addition, ART may be performed by a trained dental auxillary and does not require advanced dental equipment.



### 4.3 GINGIVITIS

The prevalence of gingivitis was 77.7% considering those children who had CPI score of equal to or greater than one. This is a high prevalence indicating that periodontal disease in children is a major public health concern in this country. The prevalence of gingivitis in this study was however lower than that previously reported in other studies done in Kenya (15, 20). Manji et al reported a prevalence of 92.1% among 11-14 year-olds (15) while Musera reported a prevalence of 98.8% among 10-12-year-old children (20). In contrast the prevalence of gingivitis in this study was higher than Butt's findings among 10-14-year-old children at Nyeri district Hospital reported to be 63.8% (32). However, direct comparison of the results should be done with caution because different indices and diagnostic criteria may have been used in the different studies. In the assessment of gingivitis most of the indices will use bleeding of the gingivae as the indicator of disease and this may allow for general comparisons to be made. However, there is always some variation in the results of the assessment of gingivitis by different clinicians even when they examine the same patient/subject. This comes out clearly when checking for bleeding on probing. Different examiners will apply different forces when checking for bleeding on probing, for instance bleeding may be elicited from normal gingivae if too much force is used.

This finding of a high prevalence of gingivitis is comparable to other studies conducted in Africa and other parts of the world which have also revealed a high prevalence of gingivitis in children (28, 29, 30). Brindle et al reported a prevalence

of 80% among 12-year-old children in Hlabisa, Kwazulu/Natal (29). The prevalence of gingivitis was however lower than what other studies reported. Al Banyan found a prevalence of 100% among 5-12-year-old children in Riyadh Saudi Arabia (28), while Mosha et al reported a prevalence of 99% in 12-14-year-olds in Tanzania (30). In contrast some areas of the world are still reporting low prevalence gingivitis. The prevalence of gingivitis in this study was higher than other studies both internationally and regionally (9, 22, 25). Jose et al in Kerala, India reported a prevalence of 15% among 12-15-year-old children. Simon et al found a lower prevalence of 53.4% among 12-year-old in Ethiopia (22), while Caranza's report in the US reported a prevalence of 58.8% (25).

The impact of high prevalence of gingivitis is mainly two fold. First, studies have shown that there is a relationship between oral hygiene/gingivitis and caries experience. Tucker et al demonstrated that dental caries experience increments were lower in children with good oral hygiene when followed up for 3 years as opposed to those with poor oral hygiene and severe gingivitis (63). Therefore with this high prevalence of gingivitis it may be expected that the caries experience could increase if preventive measures are not put in place. Secondly gingivitis could lead to the destruction of the tooth support structures followed by tooth loss (25).

Female participants had higher gingivitis prevalence than males but the difference was not statistically significant  $p>0.05$ . One may only speculate that at this point in a girl's life there are certain physiological changes associated with menarche. Therefore the higher prevalence of gingivitis in girls could be due to hormonal



changes which make the gingivae hyper-responsive to moderate plaque levels (25). Since there was no statistically significant difference in the prevalence of gingivitis between males and females, the null hypothesis was accepted.

Periodontal treatment needs are derived from the CPI scores. In this study 77.7% of the children required oral hygiene instructions with or without professional care. Out of these 38.7% had CPI score of greater than two, and these required professional cleaning of teeth (oral prophylaxis and scaling). Therefore with 77.7% of the children having gingivitis there is a strong indication that there is need for oral health preventive programmes in this population of 12-year-old children in Kitale municipality and peri-urban areas. This may necessitate training and recruitment of more Community Oral Health Officers to visit schools to provide oral hygiene campaigns, screening children for common oral diseases, carry out simple treatment like dental extractions and scaling and referral of cases that would require more complex treatment.

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#### 4.4 ORAL HYGIENE PRACTICES

Oral hygiene habits were investigated using a self administered questionnaire. Most of the children (67.5%) brushed their teeth. There was no statistically significant difference between males and females who brushed their teeth  $p > 0.05$  ( $p = 0.375$ ). Of all the children who brushed their teeth, 55.3% performed this practice three times daily. Out of the children who brushed their teeth, 87% used tooth paste, 64% of these children used a toothbrush, 16.8% used mswaki and 16.2% used mswaki and toothbrush. There was no difference in brushing habits between male and females  $p > 0.05$  ( $p = 0.534$ ).

About 52.8% of the children who brushed their teeth learnt how to brush before they joined primary school. It is highly likely that they learnt how to brush their teeth at home, indicating parental influence in the acquisition of this habit. Parents could therefore be targeted during oral health education programmes to encourage them to teach tooth brushing habits to their children. In 2004, Okada et al. in a study among elementary school children found out that parents' oral health behavior affected their children's oral health behavior (43). Okada also noted that parents' oral health behavior had a significant direct effect on their children's decayed teeth and periodontal disease (43).

The school environment also appears to influence the brushing habits of children in this study, but secondary to the home environment, with 26.9% children having learnt how to brush their teeth in primary school. Therefore if school based oral

health promotion and education is carried out it should be aimed at positive reinforcement of the oral hygiene practices the child may have learnt at home. It should also aim at educating those who had never brushed their teeth before starting primary school. Studies (Hodge et al) have shown that tooth brushing in adolescents is strongly related to cleanliness and appearance rather than to motives related to dental health (64). They also demonstrated that tooth brushing is more responsive to family and peer pressures than to the influences of dental personnel. Therefore when planning educational programmes designed to persuade adolescents to brush regularly, the involvement of tooth brushing within personal hygiene and grooming behavior and the influences of family and peer group on these practices must be taken into account (64). Once children are educated on oral hygiene, then through peer pressure and social interactions they may be able to influence their other friends to brush.

Of the children who did not brush their teeth, 79% said they could not afford a toothbrush. Although socioeconomic status was not assessed in this study, children attending public primary schools in Kitale municipality are likely to be from poor social backgrounds with their parents being either peasant farmers or farm workers in the large scale farms in the peri-urban areas. Most of these children attended school because their parents have taken advantage of the free primary education. This may be the reason why some children said they could not afford a toothbrush. Another possible reason for not brushing is the family size. Families in Kitale are large and data from Kenya demographic health survey (KDHS) the total fertility rate (TFR) in this area is an average of 5.8 children per mother (65). Therefore mothers may not have the time to teach the children how to brush and



supervise the same. Studies have shown that mothers who have large families may not be able to teach their children oral hygiene procedures and supervise the brushing (64). Lack of awareness constituted only a small proportion (7.9%) of those children who did not brush their teeth.

Children who brushed their teeth had a higher caries experience (DMFT 0.94) compared to those who did not brush (DMFT 0.88). The difference was however not statistically significant ( $p > 0.05$ ), indicating that tooth brushing had no influence on the caries experience among the children in this study. This finding though unexpected has been reported by other authors (20, 63). The likely explanation lies in the fact that for tooth brushing to be effective in preventing caries in children, other factors like parental supervision, use of fluoridated tooth paste and diet control need to be practiced (66). In this study the frequency of tooth brushing did not reduce the caries experience. However this is contrary to what Ashley et al reported (67). They found out that tooth brushing twice a day reduced caries experience when compared to brushing once a day. Similar findings have been reported by Tucker et al (63). It can only be speculated that the 12-year-old children in Kitale municipality may have been inaccurate in their response to brushing habits or their brushing times and technique were ineffective. However strong conclusions cannot be made because this was not a controlled study and therefore there could be other confounding factors.

Studies have shown that the use of fluoridated toothpaste reduced the prevalence of dental caries (66). However in this study, when the use of toothpaste was correlated with caries experience, children who brushed their teeth with tooth paste

had a higher caries experience than those who did not and the difference was statistically significant  $p < 0.05$  ( $p = 0.02$ ). This may suggest that either the children were not truthful in declaring the use of toothpaste, or there was inconsistency in the usage of toothpaste.

Tooth brushing, frequency of tooth brushing and the use of toothpaste did not influence the prevalence of gingivitis. There was no statistically significant difference in the prevalence of gingivitis between those children brushed their teeth against those who did not, and also between those who used toothpaste against those who did not. Epidemiological studies worldwide have shown that tooth brushing reduces the incidence of gingivitis which is contrary to the findings of this study. This implies that these children were either not honest as to whether they brush their teeth or not, or are not effective in their oral hygiene procedures. A controlled supervised longitudinal study may shed some light on this paradoxical finding.



#### 4.5 KNOWLEDGE ON AETIOLOGY AND PREVENTION OF ORAL DISEASES.

The knowledge on aetiology and prevention of dental diseases was investigated using a questionnaire. Levels of knowledge were assessed and scores given out of 6. Those who scored between 0 and 2 were graded as poor, between 3 and 4 moderate and between 5 and 6 as good. Research has shown that in questions concerning exact facts, validity and reliability of answers by adolescents about oral health knowledge and habits is high (68). Most of the children (74%) would have wanted the dentist to extract their teeth. Majority of the children (86%) thought eating sweets causes tooth decay, while 85.3% of the children knew that dental diseases are preventable.

Majority of these children (69.9%) had moderate knowledge of oral health issues indicating that these children are well versed in the various oral health issues with regards to aetiology and prevention of oral diseases. This level of knowledge is similar to that which was found in a previous study by Musera in a similar group of children (20). However, knowledge on aetiology of dental caries and gingivitis did not influence neither the caries experience nor the prevalence of gingivitis ( $p > 0.05$ ). Therefore the null hypothesis that knowledge and attitude on aetiology of dental caries and gingivitis had not influenced the prevalence of the two diseases was accepted. This demonstrates the gap between knowledge and practice that is usually a concern in oral health education programmes. Probably the children may have the knowledge but lack the ability to apply what they theoretically know. It

becomes imperative that oral health education should encompass practical demonstration sessions as well as public health lectures and distribution of pamphlets.

#### 4.6 ORAL HEALTH SEEKING BEHAVIOUR

Out of all children examined, only 36.3% had ever visited a dentist before while 63.7% had never visited a dentist. This indicates low utilization of dental services by these children. Although more females (37.5%) than males (35.0%) went to the dentist the difference was not statistically significant  $p > 0.05$ . This level of utilization is similar to that of 12-year-old children in Kerala, India (68). In contrast, the level of attendance by the 12-year-old children in Kitale is low compared to that of 96% in Finnish adolescent population (67), 89% in Jordan (69) and 58% in china (70). In Kenya where majority of the population may be ignorant of dental services available, most people would visit the dentist only when in pain. In this study majority of those who visited the dentist, 18.2% of all children went for dental extractions, 6.8% went for tooth cleaning and 4.1% went for a restoration. One can only speculate that since these children went for extractions, pain may have been the chief complaint. Pain has been reported as the main reason for attendance among children seen at dental clinics (71, 72). A study in Scotland where extractions are relatively common revealed that irregular attendance to the dental clinic was a contributor to the higher tooth morbidity rates (73). This irregular attendance is also suspected in this population. In this study there were no filled teeth, and therefore the 4.1% who said they attended for fillings either gave

inaccurate responses, or had fillings on deciduous teeth which later on exfoliated naturally. Although the caries experience was higher among the children who had visited the dentist than those who had not, the difference was not statistically significant  $p>0.05$ . This may indicate that dental visits by the children were symptom oriented. Only children who tended to suffer from dental disease attended the dental clinic.

A small percentage of the children (12%) visited the dentist for dental check up. This demonstrates that the habit of going to hospital for routine check up is not deep rooted in our society. Similar results have been shown in other studies (71, 72). Some of the reasons underlying failure to seek dental treatment have been evaluated by Wakiaga et al and include fear of the dentist, dental disease not considered serious, lack of money and notion that the problem would resolve on its own (74). These reasons may also be applicable within the population of 12-year-old children examined in Kitale. Lack of oral health awareness and low socioeconomic status are probably the reasons why most Kenyans do not consider going for routine check ups. The importance of regular dental check ups should be encouraged through community awareness programmes.

## 4.7 CONCLUSION

The overall prevalence of dental caries was 50.3% and there was no gender difference ( $p>0.05$ ). The caries experience was DMFT 0.92, and this was well within the WHO oral health global average for the year 2000. The demand for dental restorations was 46.9% and that of pulp care was 5.1% among these children.

The prevalence of gingivitis was 77.7% and this can be considered to be a high prevalence. There was no gender difference in the prevalence of gingivitis. There was a high demand for periodontal treatment. Most of the children (77.7%) required oral hygiene instructions while 38.7% required full mouth scaling."

At least 67.5% of the children brushed their teeth. Out of those children who brushed their teeth, 87.8% used toothpaste while 64.5% used a toothbrush only. Most of the children (55.3%) brushed their teeth three times a day. A large number of children (69.9%) had moderate knowledge on aetiology and prevention of dental caries. The utilization of dental services remained very low with only 36.3% of the children having visited the dentist.

Oral hygiene practices, oral health seeking behaviour and knowledge did not have any significant effect on the dental caries experience and on the prevalence of gingivitis ( $p>0.05$ ). Therefore there was a gap between knowledge and practices of oral hygiene.



## 4.8 RECOMMENDATIONS

1. Oral health preventive measures should be instituted among the children of Kitale municipality and peri-urban areas. This should include the use of fissure sealants, oral health education for parents and children, oral health promotion and advocacy programmes. This may be achieved through integrating oral health into primary care as is the case in other developing countries such as Bangladesh, Nepal, Indonesia and Tanzania (75)
2. In view of the limited resources and non functional dental equipment in Kitale municipality, the government should endeavour to encourage the use of Atraumatic Restorative Technique (ART) which doesn't require elaborate dental equipment to perform.
3. Fissure sealants are highly indicated among these children since the first permanent molars were most severely affected by dental caries among these children.
4. A National oral health survey should be conducted to map out dental disease patterns in the whole country and follow up studies in Kitale to enable formulation of better intervention measures



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## QUESTIONNAIRE ON ORAL HEALTH KNOWLEDGE AND PRACTICES

1) Do you brush your teeth

- a. Yes
- b. No

If yes go to question 2, if no go to question 7

2) When did you start brushing your teeth?

- a. Before primary school
- b. In primary school
- c. This year
- d. I don't remember

3) How many times do you brush your teeth

- a. Three times a day
- b. Twice a day
- c. Once a day
- d. Rarely
- e. Never

4) What do you use to brush your teeth

- a. Mswaki (traditional chewing stick)
- b. Commercial toothbrush
- c. Toothbrush and mswaki
- d. Tooth picks
- e. Finger
- f. Charcoal
- g. Others (specify) \_\_\_\_\_

5) Do you use tooth paste

- a. Yes
- b. No

6) Who taught you how to brush

- a. At school
- b. By a friend

- c. By parent/ relative
- d. By a dentist/ other health worker
- e. Other (Specify)\_\_\_\_\_

7) Why don't you brush your teeth

- a. We cannot afford a toothbrush and toothpaste
- b. Stopped because brushing teeth was not helpful to me
- c. Never known people brush teeth
- d. None of the above

8) Have you ever visited a dentist

- a. Yes
- b. no

If yes answer question 9 and 10 and skip no 13.

If no go to question 12.

9) Why did you visit the dentist the first time

- a. Extractions (Removal of tooth)
- b. Tooth cleaning
- c. Filling
- d. Check-up
- e. Other (Specify)\_\_\_\_\_

10) Would you wish to visit the dentist again

- a. Yes
- b. No

11) Why wouldn't you want to see a dentist again?

- a. It was a painful experience
- b. He keeps removing my teeth and nothing else
- c. My parents cannot afford dental treatment

**KNOWLEDGE**

12) Why do you brush your teeth

- a. To prevent tooth decay (rotting teeth)
- b. To prevent gum disease (bad gums)
- c. To make my teeth whiter

- d. To prevent bad breath and feel fresh
- e. Because of a, b and d
- f. I don't know
- g. Others (Specify) \_\_\_\_\_

13) Why have you never visited a dentist

- a. I don't think it is necessary
- b. I have never had a need to
- c. Lack of Money
- d. I fear dentists
- e. I don't know where to find one
- f. The dentist will spoil my teeth

14) What would you prefer the dentist to do if you had a toothache

- a. Remove the tooth (extraction)
- b. Fill the tooth
- c. Give medicine
- d. Clean the tooth
- e. I don't know

15) What causes tooth decay (rotten teeth)

- a. Germs (bacteria)
- b. Eating sweets
- c. Water
- d. Brushing teeth
- e. a and b
- f. I don't know

16) Do you think tooth decay can be prevented

- a. Yes
- b. No

17) Which foods will cause tooth decay (rot) -tick into the correct box

Sweets, biscuits, cakes, chocolates, soda

Cabbage, sukumawiki, beans, rice

Meat, fish.

Water




18) What causes bleeding gums

- a. Bacteria on teeth
- b. Lack of vitamins
- c. Dirt on teeth
- d. Failure to brush teeth

Other (Specify) \_\_\_\_\_

# DATA COLLECTION FORM

Name: \_\_\_\_\_

Registration Number: \_\_\_\_\_

Sex: Male \_\_\_\_\_ Female \_\_\_\_\_

Age in years: \_\_\_\_\_

Name of School: \_\_\_\_\_

## EXAMINATION FOR DENTAL CARIES & TREATMENT NEEDS

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Crown																																																		
Treatment Need																																																		

APPENDIX 2

Permanent Teeth	Status	Treatment
0	Sound	None; P=preventive caries arresting care; Fissure Sealant.
1	Decayed	One surface filling
2	Filled & decayed	2 or More surface filling
3	Filled no decay	Crown for any reason
4	Missing due to caries	Veneer or laminate
5	Missing any other reason	Pulp care and restoration
6	Fissure sealant	Extraction
7	Bridge abutment / crown/ veneer/ implant	Need for other care (specify)
8	Unerupted tooth	
9	Not recorded	Not recorded

## EXAMINATION FOR PERIODONTAL DISEASE

16	11	26
46	31	36

Code	Status of Periodontics
0	Healthy
1	Bleeding
2	Calculus or other plaque retentive factors
3	Pathological pocket 4 to 5mm in depth
4	Pathological pocket 6mm or more

Treatment needs (TN)	Status
TN-0	A recording of code healthy "o" (healthy) or code Y (missing) all six sextants indicates that there is no treatment need.
TN-1	A code of 1 or higher indicates a need for improving the personal oral hygiene of the individual
TN-2	A code of 2 or 3 indicates need for professional cleaning of teeth and removal of plaque retentive factors
TN-3	A code of 4



**KENYATTA NATIONAL HOSPITAL**

Hospital Rd. along, Ngong Rd.

P.O. Box 20723, Nairobi.

Tel: 726300-9

Fax: 725272

Telegrams: "MEDSUP", Nairobi.

Email: [KNHplan@Ken.Healthnet.org](mailto:KNHplan@Ken.Healthnet.org)**Date: 7<sup>th</sup> September 2005****Ref: KNH-ERC/01/2980**

Dr. Richard O.Owino  
 Dept. of Paediatric Dentistry & Orthodontics  
 Faculty of Dental Sciences  
 University of Nairobi

Dear Dr.Owino

**RESEARCH PROPOSAL: "DENTAL CARIES AND GINGIVITIS AMONG 12 YEAR OLD CHILDREN IN KITALE MUNICIPALITY, TRANS-NZOIA DISTRICT, KENYA" (P77/5/2005)**

This is to inform you that the Kenyatta National Hospital Ethics and Research Committee has reviewed and approved revised version of your cited research proposal for the period 7<sup>th</sup> September 2005 – 6<sup>th</sup> September 2006. You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given.

On behalf of the committee, I wish to fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of database that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely

**PROF A N GUANTAI**  
**SECRETARY, KNH-ERC**

c.c. Prof. K.M.Bhatt, Chairperson, KNH-ERC

The Deputy Director CS, KNH

The Dean, Faculty of Dental Sciences, UON

The Chairman, Dept. of Paediatric Dentistry &amp; Orthodontics, UON

The HOD, Medical Records, KNH

Supervisors: Dr. Mary Masiga, Dept. of Paediatric Dentistry and Orthodontics, UON

Prof. P.M. Ng'ang'a, Dept. of Paediatric Dentistry &amp; Orthodontics, UON

Dr. F.G. Macigo, Dept. of Periodontology &amp; Community Dentistry, UON

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## CONSENT FORM

Dear Parent/ Guardian

I am a master's student at the University of Nairobi, pursuing studies specialising in children dentistry. I wish to request for your permission for your child to participate in a study that will form part of my degree work.

**Purpose of study:** To evaluate the dental health status of 12-year old children in Kitale municipality.

**Procedure:** Your child will answer some questions relating to oral hygiene and dental health care. Your child will undergo a dental check up to determine any dental health problem. The clinical examination will be undertaken with the highest standards of hygiene using sterile mouth mirror and probe only. The examination will be painless and non-invasive.

**Risks:** There will be no dental procedures performed on your child during the study therefore there are no risks involved. Your child will not be given any form of medication but should any problems be detected, they will be referred to a dentist with a referral note.

**Confidentiality:** All information regarding your child will be kept strictly confidential and used for this research purpose only. Participation of your child in this study will be voluntary and your child will be allowed to drop out of the study on his/her own wishes at any time if they need to.

Please sign accordingly below.

I agree to have my child participate in this study

Name of parent/ guardian \_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_

I do not agree to have my child participate in this study

Name of parent/ guardian \_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_

**Contact of investigator:** Dr. Richard Owino, Department of Paediatric Dentistry and Orthodontics, University Of Nairobi. Tel: 0722758247.